

# Thomas W. Secord

## Curriculum Vitae

### CONTACT INFORMATION

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### EDUCATION

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**Massachusetts Institute of Technology** · Cambridge, Massachusetts **September 2005 – June 2010**  
Ph.D., Mechanical Engineering (June 2010)  
S.M., Mechanical Engineering (February 2007)

**University of Minnesota** · Minneapolis, Minnesota **September 2001 – May 2005**  
Bachelor of Mechanical Engineering, *summa cum laude*  
Minor in Mathematics

### CERTIFICATIONS

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**Licensed Professional Engineer, Minnesota (LN: 52692)** **June 2015 – Present**

**Black Belt, Medtronic Design for Reliability and Manufacturability** **May 2015 – August 2016**

### RESEARCH AND PRODUCT DEVELOPMENT EXPERIENCE

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**University of St. Thomas** · St. Paul, Minnesota **September 2016 – Present**  
Assistant Professor, Mechanical Engineering

**Medtronic** · Mounds View, Minnesota **July 2010 – August 2016**  
Principal R&D Engineer, Structural Heart Product Development (July 2015 – August 2016)  
Senior R&D Engineer, Structural Heart Product Development (July 2010 – July 2015)

**Massachusetts Institute of Technology** · Cambridge, Massachusetts **September 2005 – June 2010**  
Postdoctoral Associate, d'Arbeloff Laboratory (May 2010 – June 2010)  
Research Assistant, d'Arbeloff Laboratory (September 2005 – May 2010)

**Medtronic** · Fridley, Minnesota **November 2002 – April 2005**  
Design Engineering Intern, Cardiac Rhythm Disease Management - Therapy Delivery

### TEACHING EXPERIENCE

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**University of St. Thomas** · St. Paul, Minnesota **Fall 2016 – Present**  
Assistant Professor, Mechanical Engineering

- ENGR 410 - Control Systems and Automation
- ENGR 150 - Introduction to Engineering
- ETL5 555 - Advanced Product Design
- ETL5 810 - Advanced Control Systems
- ENGR 480 & 481 - Engineering Design Clinic (Project Advisor)

**Medtronic** · Mounds View, Minnesota **Fall 2013 – Summer 2016**  
Design for Reliability and Manufacturability Course Instructor

**University of Minnesota** · Minneapolis, Minnesota **Summer 2012 and Fall 2012**  
Guest Lecturer, Engineering Modeling (ME 4080)

**Massachusetts Institute of Technology** · Cambridge, Massachusetts **Fall 2006 – Spring 2008**  
Teaching Assistant, 2.12 - Introduction to Robotics (Fall 2006, Fall 2008)  
Grader, 2.160 - System Identification, Estimation, and Learning (Spring 2008)  
Solution Writer and Grader, 2.140 - Analysis and Design of Feedback Control Systems (Spring 2007)

## HONORS AND AWARDS

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- Medtronic Technical Contributor of the Year (Member of 6 person team selected from 18,000+ technical employees), 2014
- Medtronic Global Preclinical Excellence Award Nominee, 2014
- Best Paper Award (Best of 113 total papers), IFAC Symposium on Mechatronic Systems, 2010
- Best Automation Paper Finalist (Top 4 of 850 total papers)- IEEE International Conference on Robotics and Automation, 2008
- Martin Fellowship - MIT Laboratory for Energy and the Environment, 2005-2006
- United States Youth Biathlon Team, 2001
- Eagle Scout Rank, Boy Scout Troop 399, New Brighton, Minnesota, 2000

## VOLUNTEER AND MENTORING EXPERIENCE

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- Medtronic manager and mentor, U. of Minnesota and Cornell co-op students, September 2010 - Summer 2016
- FIRST Robotics Team Mentor, Irondale High School, September - November 2010
- Science, Technology, Engineering, and Mathematics (STEM) Mentor, MIT, October 2009 - May 2010

## PUBLICATIONS

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### Journal Publications (Refereed)

- [J1] T. Secord, T. Louwagie, and R. Kopas, "Design of discretely-tunable resonant actuators using additive inertial units," *ASME Journal of Dynamic Systems Measurement and Control*, vol. 142, no. 3, pp. 031009-1 - 031009-13, 2020. <https://doi.org/10.1115/1.4045562>
- [J2] L. Koerner and T. Secord, "An embedded electrical impedance analyzer based on the AD5933 for the determination of voice coil motor mechanical properties," *Sensors and Actuators A: Physical*, In Press, 2019, vol. 295, pp. 99-112, 2019. <https://doi.org/10.1016/j.sna.2019.05.037>
- [J3] K. Seino, T. Secord, M. Vig, S. Kyllonen, and A. DeClue, "Three-dimensional kinematic motion analysis of shivers in horses: a pilot study," *Journal of Equine Veterinary Science*, vol. 79, pp. 13-22, 2019. <https://doi.org/10.1016/j.jevs.2019.03.006>
- [J4] T. Secord and M. Audi, "A tunable resonance cantilever for cardiac energy harvesting," *Cardiovascular Engineering and Technology*, vol. 10, no. 2, pp. 380-393, 2019. <https://doi.org/10.1007/s13239-019-00402-9>
- [J5] T. Secord and A. J. Gerenz, "Development of a robotic surgery game for use as a full spectrum engineering project," *Transactions on Techniques in STEM Education*, vol. 3, no. 1, pp. 41-47, 2017. (Reprint of [C7])
- [J6] T. Secord, S. C. Mantell, and K. A. Stelson, "Scaling analysis and a critical thickness criterion for thermosetting composites," *ASME Journal of Manufacturing Science and Engineering*, vol. 133, no. 1, 2011. <https://doi.org/10.1115/1.4003338>
- [J7] T. Secord and H. H. Asada, "A variable stiffness PZT actuator having tunable resonant frequencies," *IEEE Transactions on Robotics*, vol. 26, no. 6, pp. 993-1005, 2010. <https://doi.org/10.1109/TRO.2010.2076850>
- [J8] J. Ueda, T. Secord, and H. H. Asada, "Large effective-strain piezoelectric actuators using nested cellular architecture with exponential strain amplification mechanisms," *IEEE/ASME Transactions on Mechatronics*, vol. 15, no. 5, pp. 770-782, 2010. <https://doi.org/10.1109/TMECH.2009.2034973>

### Book Chapters

- [B1] T. Secord and H. H. Asada, "Cellular muscle actuators with variable resonant frequencies," *Robotics: Science and Systems*, pp. 249-256, 2009. <https://doi.org/10.15607/RSS2009.V.032>

### Conference Publications (Refereed)

- [C1] H. Liu, S. Laflamme, E. Zellner, S. Bentil, I. Rivero, T. Secord, and A. Tamayol, "Corrugated Compliant Capacitor for Smart Bandage Application," *IEEE International Instrumentation and Measurement Technology Conference (Accepted for Podium Presentation)*, May 2021.

- [C2] **T. Secord** and T. Louwagie, "Bidirectional Resonant Propulsion and Localization for AUVs," IEEE International Conference on Robotics and Automation, pp. 878-884, Virtual Conference, June 2020. <https://doi.org/10.1109/ICRA40945.2020.9197363>
- [C3] **T. Secord**, L. Koerner, and R. Kopas, "An integrated I2C sensor network for transcatheter heart valves," ASME Design of Medical Devices Conference, Vol. 83549, Virtual Conference, April 2020. <https://doi.org/10.1115/DMD2020-9016>
- [C4] **T. Secord**, A. Tenhoff, M. Audi, A. Lorch, "A multi-actuator approach to high bandwidth *in vitro* cardiac kinematic simulation," IEEE International Conference on Biorobotics and Biomechanics, pp. 833-838, Enschede, Netherlands, May 2018. <https://doi.org/10.1109/BIROB.2018.8487781>
- [C5] **T. Secord**, M. Audi, "A high efficiency tunable resonance pump for biomedical applications," Design of Medical Devices Conference, DMD2018-6917, Minneapolis, Minnesota, April 2018. <https://doi.org/10.1115/DMD2018-6917>
- [C6] **T. Secord** and A. J. Johnson, "A tunable-resonance Faraday device for dual cardiac sensing and energy harvesting," IEEE Medical Measurements and Application Symposium, pp. 257-262, Rochester, Minnesota, May 2017. <https://doi.org/10.1109/MeMeA.2017.7985885>
- [C7] **T. Secord** and A. J. Gerenz, "Development of a robotic surgery game for use as a full spectrum engineering project," ASEE North Midwest Section Conference, Minneapolis, Minnesota, June 2017.
- [C8] **T. Secord** and H. H. Asada, "Scaling analysis of large stroke piezoelectric cellular actuators," IFAC Symposium on Mechatronic Systems, pp. 131-136, Boston, Massachusetts, September 2010 (**Best Paper Award**). <https://doi.org/10.3182/20100913-3-US-2015.00061>
- [C9] **T. Secord** and H. H. Asada, "The present role of actuator technology in surgical robotic devices," ASME Design of Medical Devices Conference, Minneapolis, Minnesota, April 2010.
- [C10] **T. Secord**, A. Mazumdar, and H. H. Asada, "Piezoelectric device for tunable resonance actuation and energy harvesting," IEEE International Conference on Robotics and Automation, pp. 2169-2176, Anchorage, Alaska, May 2010. <https://doi.org/10.1109/ROBOT.2010.5509158>
- [C11] **T. Secord** and H. H. Asada, "A variable stiffness PZT cellular actuator with tunable resonance for cyclic motion tasks," IEEE International Conference on Robotics and Automation, pp. 176-181, Kobe, Japan, May 2009. <https://doi.org/10.1109/ROBOT.2009.5152288>
- [C12] J. Ueda, **T. Secord**, and H. H. Asada, "Piezoelectric cellular actuators using nested rhombus multilayer mechanisms," ASME Dynamic Systems and Control Conference, vol. 2008, pp. 203-210, Ann Arbor, Michigan, October 2008. <https://doi.org/10.1115/DSCC2008-2128>
- [C13] **T. Secord**, J. Ueda, and H. H. Asada, "Dynamic analysis of a high-bandwidth, large-strain, pzt cellular muscle actuator with layered strain amplification," IEEE International Conference on Robotics and Automation, pp. 761-766, Pasadena, California, May 2008 (**Finalist for Best Automation Paper Award**). <https://doi.org/10.1109/ROBOT.2008.4543297>
- [C14] J. Ueda, **T. Secord**, and H. H. Asada, "Static lumped parameter model for nested pzt cellular actuators with exponential strain amplification mechanisms," IEEE International Conference on Robotics and Automation, pp. 3582-3587, Pasadena, California, May 2008. <https://doi.org/10.1109/ROBOT.2008.4543759>
- [C15] **T. Secord**, J. Ueda, and H. H. Asada, "Static analysis of an artificial muscle system based on pzt strain amplification," SPIE - The International Society for Optical Engineering, vol. 6932, San Diego, California March 2008. <https://doi.org/10.1117/12.775868>
- [C16] J. Ueda, **T. Secord**, and H. H. Asada, "Design of pzt cellular actuators with power-law strain amplification," IEEE International Conference on Intelligent Robots and Systems, pp. 1160-1165, San Diego, California, October 2007. <https://doi.org/10.1109/IROS.2007.4399299>
- [C17] **T. Secord** and H. H. Asada, "A humanoid foot with polypyrrole conducting polymer artificial muscles for energy dissipation and storage," IEEE International Conference on Robotics and Automation, pp. 2904-2909, Rome, Italy, April 2007. <https://doi.org/10.1109/ROBOT.2007.363912>
- [C18] D. McCombie, **T. Secord**, and H. H. Asada, "Modeling and observer design for polypyrrole conducting polymer actuator control systems," IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechanics, pp. 432-436, Pisa, Italy, February 2006. <https://doi.org/10.1109/BIROB.2006.1639126>

- [C19] **T. Secord**, K. Stelson, and S. Mantell, "Scaling analysis and a critical thickness criterion for thermosetting composites," ASME IMECE, pp. 205–211, Chicago, Illinois, November 2006.  
<https://doi.org/10.1115/IMECE2006-15344>

#### Extended Abstracts

- [A1] **T. Secord**, F. Harewood, C. McVeigh, B. Nadian, and E. Donnelly, "Copula based probabilistic modeling of use conditions for self-expanding transcatheter valve structural components," Proceedings -ASME/FDA First Annual Frontiers in Medical Devices Conference: Applications of Computer Modeling and Simulation, September 2013. <https://doi.org/10.1115/FMD2013-16170>

#### Patents

- [P1] J. Quill, P. Rothstein, **T. Secord**, and B. Johnson, "Transcatheter valve prosthesis delivery system with recapturing feature and method," US Patent 20140128963.
- [P2] J. Ueda, H. H. Asada, and **T. Secord**, "Strain amplification devices and methods," US Patent 20090115292.